25. (new) A method for automatically determining a transmitter power level, the method comprising:

(a) determining a noise level;

(b) determining a lowest signal amplitude level that is displayable for a given display dynamic range and gain settings; and

(c) setting a transmit power as a function of the noise level and the lowest signal amplitude value.

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REMARKS

In the Office Action, the Examiner rejected claims 1-24 pursuant to 35 U.S.C. §103(a) as being unpatentable over Mucci et al. (U.S. Patent No. 6,512,854). Applicants respectfully request reconsideration of claims 1-24, including independent claims 1, 10, 16, 23 and 24.

Independent claim 1 requires determining a lowest value of a display dynamic range and setting a transmit power as a function of a noise level and the lowest value of the display dynamic range. Likewise, independent claim 10 requires a processor operative to set the transmit power level as a function of a noise level and a lowest value of a display dynamic range.

As acknowledged by the Examiner, Mucci et al. do not disclose the above limitations. Mucci et al. disclose optimizing the data display of noise and signal information (col. 3, lines 45-60). Noise information is separated from signal information by signal enhancement (col. 8, lines 17-38). Values classified as signal are increased, and values classified as noise are decreased (col. 8, lines 52-59). A gray scale map is then used to map the resulting values within the dynamic range (col. 9, lines 3-9). Running averages or means of the signal amplitudes and noise amplitudes are separately maintained (col. 7, line 65-col. 8, line 9). Transmit power is "set on the basis of signal power relative to the noise power (S/N) as determined from the estimates of signal and noise mean" (col. 9, line 58-col. 10, line 13). To set the transmit power, Mucci et al. use mean signal values and mean noise values. Mucci et al. do not disclose setting the transmit power as a function of the lowest value of the dynamic range and the noise value.

The Examiner alleges it would have been obvious to recognize that the amplitude (see Fig. 7) defines the transmitter power level of the ultrasound signal for imaging an object and that the motivation for determining transmitter power level as a function of noise level is to provide an ultrasound image with higher resolution. A person of ordinary skill in the art would not have recognized that the amplitude of noise or signal values defines the transmitter power level. Figure 7 shows that total amplitude is the sum of the noise and signal values. Figure 7 is provided to compare the frequency of occurrence of signal and noise parameters (col. 12, lines 30-36). The distribution shown has a signal mean of 7.75 and a noise mean of 4.5. This distribution is used to identify a gray scale map, not the transmit power level (col. 12, lines 36-48 and the "Auto-Generation of Gray Scale" heading at col. 11, line 34). The transmit power level may affect the amplitude of noise or signal values, but the amplitude does not define the transmitter power level. Accordingly, the recognition asserted by the Examiner is not obvious.

Even if the definition asserted by the Examiner were accurate, the recognition does not provide for setting the transmit power as a function of the lowest value of the dynamic range. Figure 7 is used to identify mean noise and mean signal values (col. 12, lines 30-36). Mucci et al. teach setting the transmit power based on the mean signal and mean noise values (col. 9, line 66-col. 10, line 13). A person of ordinary skill in the art, even if reading Figure 7 out of context to relate to transmit power rather than gray-scale mapping, would have used the mean noise and mean signal values to set the transmit power. There is no suggestion to use the lowest value of the display dynamic range for setting the transmit power.

The Examiner mentions amplitude defining transmitter power level where amplitude is a function of noise and motivation to determine transmit power level as a function of noise. Given this information, a person of ordinary skill in the art would have used the mean signal and mean noise values as suggested by Mucci et al. to determine transmit power level. The Examiner does not even mention using the lowest value of the display dynamic range as part of determining the transmit power level. There is no suggestion to use the lowest value of the display dynamic range as part of determining the transmit power level.

The Examiner does not allege any motivation to determine transmit power level as a function of the lowest value of the display dynamic range. As taught by Mucci et al., mean noise and mean signal are used to determine the transmit power level. The motivation is to

provide a desired signal-to-noise ratio. The separation and gray scale mapping operations provide the higher resolution due to the separation of noise from signal. There is no motivation to use other signal values than the mean for determining transmit power, and there is no motivation to use the lowest value of the display dynamic range for determining transmit power.

Using the lowest value of the display dynamic range does not use an actual signal from the object, except for the fact that the actual signal from the object may be (or may not be) used by the user or by the system to set the system gain and to set the display dynamic range. For example in one system, the lowest value, in the log domain, may be the lowest signal level displayable for the current display dynamic range and system gain minus the local mean noise level. Excess signal-to-noise ratio is used to set the transmit power, not the signal-to-noise ratio (mean signal and mean noise) proposed by Mucci et al.

Independent claim 16 requires determining an excess signal-to-noise ratio with a processor and determining a transmitter power reduction factor as a function of the excess signal-to-noise ratio. Similarly, independent claim 23 requires determining an excess power with a processor and determining a transmitter power reduction factor as a function of the excess power. As discussed above for claim 1, the cited teachings of Mucci et al. merely lead to the use of mean signal and mean noise to set the transmit power. The mean values are used by Mucci et al. to provide a desired signal-to-noise ratio, contrary to reducing transmit power as a function of an excess signal-to-noise ratio. Mucci et al. seek to separate the noise information from the signal information, such as by increasing the difference between the noise mean and the signal mean. Mucci et al. set the transmit power level based on the mean signal and mean noise to achieve a desired signal-to-noise ratio (col. 9, line 66-col. 10, line 13). As a result, Mucci et al. do not determine an excess signal-to-noise ratio and do not determine a transmitter power reduction factor as a function of the excess signal-to-noise ratio.

There is no suggestion to determine any excess signal-to-noise ratio. Mucci et al. suggest setting the transmit power level to provide a desired signal-to-noise ratio. In two examples, Mucci et al. set the transmit power level to be at a particular value to obtain a particular signal-to-noise ratio, one high and one at 3 dB (col. 10, lines 1-10). The particular signal-to-noise ratio is set based on the signal mean and noise mean. Mucci et al. determine the

transmit power level from these two inputs. There is no suggestion that there may be excess signal-to-noise ratio for reducing the transmit power level from the level determined by Mucci et al. or any other method. Mucci et al. set the transmit power based on the two mean inputs to obtain a target ratio, so there is no suggestion to determine any excess ratio.

Independent claim 24 requires iteratively reducing a transmit power, determining a difference between a first signal at a default power level and a second signal at a power level responsive to the iteratively reduced transmit power, and selecting the transmit power where the difference exceeds a threshold. Mucci et al. describe setting the transmit power as calculated from the mean signal and mean noise. Later values of the mean signal and mean noise may be determined and used to set the transmit power again. It is possible that the transmit power will be reduced two or more times due to calculation of different mean signal and/or mean noise levels. However, resetting the transmit power based on new mean signal and mean noise values does not suggest determining a difference and does not suggest selecting where the difference is above a threshold. Mucci et al. do not suggest selecting a transmit power based on the difference between signals at different power levels.

Mucci et al. teach maintaining a particular signal-to-noise ratio (col. 10, lines 1-13). To maintain the signal-to-noise ratio, the transmit power is automatically set based on the mean signal and mean noise. Resetting based on new mean signal or mean noise values does not require or suggest determining a difference. By seeking to maintain a particular signal-to-noise ratio, Mucci et al. teach away from iterative reduction in transmit power where a difference between signals, one of which is responsive to the iterative reduction, is determined as part of setting the transmit power.

The dependent claims 2-9, 11-15 and 17-22 depend from the independent claims 1, 10 and 16 discussed above, so are allowable for the same reasons. The dependent claims are further allowable for additional limitations in the dependent claims not suggested or obvious from Mucci et al.

For example, Mucci et al. do not disclose reducing a default transmit power by a factor that is a function of a determined excess signal-to-noise ratio as claimed in claims 2, 3 and 11.

Mucci et al. set the transmit power based on signal and noise mean values to provide a particular signal-to-noise ratio (col. 10, lines 1-13). Setting the transmit power from two inputs does not suggest determining an excess signal-to-noise ratio. Mucci et al. use a formula with mean signal and mean noise inputs. The output transmit power changes as the mean signal or mean noise change. However, Mucci et al. do not suggest determining any excess, only setting based on a formula.

As further examples, Mucci et al. do not suggest: preserving brightness based on setting a gain as a function of transmit power and independent of user settings as claimed in claims 4 and 12 (Mucci et al. set the gain to constrain data to a range suited for the electronics, operator controls and display intensities – col. 10, lines 14-17); calculating a difference between the noise level and the lowest value and reducing the transmit power as a function of the difference as claimed in claims 5 and 13; predicting a noise level for current imaging parameters as a function of an actual noise level as claimed in claim 7; determining a noise level from a table in response to current imaging parameters as claimed in claims 8 and 15 (Mucci et al. teach measuring the noise level); performing the claimed acts independently for different regions of an imaging field as claimed in claim 9; displaying the transmitter power reduction factor as claimed in claim 17; initiating determination of the excess and the power reduction factor in response to user input as claimed in claim 19 (Mucci et al. provide for automatic setting once the user configures the system, so would not have suggested initiating in response to user input); recalculating a transmit power level in response to a change in an imaging parameter and initiating determination of excess in response to recalculating as claimed in claim 20 (Mucci et al. automatically calculate the transmit power with the mean signal and mean noise, but do not suggest any triggers for the determination of transmit power); and calculating the excess as a function of the difference between a minimum display signal level and a noise level as claimed in claim 21.

CONCLUSION:

Applicants respectfully submit that all of the pending claims are in condition for allowance and seeks early allowance thereof. If for any reason, the Examiner is unable to allow the application but believes that an interview would be helpful to resolve any issues, he is respectfully requested to call the undersigned at (650) 943-7350 or Craig Summerfield at (312) 321-4726.

Respectfully submitted,

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